REMARKS

Regarding the Claim Amendments presented in this reply:

The amendments to the claims add no new matter. The amendment to claim 1 finds support in original claim 6, and in claim 6 as previously presented. Claims 5 and 6 are canceled. The amendment to claim 7 merely ensures that claim 7 depends from a pending claim, i.e. claim 1.

Regarding the Prosecution History:

Applicants are thankful for the Examiner's diligent efforts to advance this application to allowance and are pleased to have this opportunity to address the Examiner's remaining concerns. Upon careful review of the remarks presented in this reply, the Examiner will agree that the claimed invention is patentable and that this application is in good condition for allowance.

In the non-final Office Action of July 03, 2007, the Examiner rejected claims 1 – 9 under 35 U.S.C. §103(a) over *Saito et al.* (EP 1011164) in view of *Thielen et al.* (US 6,331,586).

The Examiner acknowledged that the *Saito et al.* reference "does not expressly teach that the binder comprises a polymer blend which includes at least two mutually nonmiscible blend polymers in a co-continuous or intercalated structure, as recited in claim 1."[1] However, the Examiner asserted that a skilled artisan would have been motivated to modify the teaching of *Saito et al.* by using the co-continuous polymer blend of *Thielen et al.* because of the following three statements in the *Thielen et al.* reference:

- "Another object of the invention is to provide a conductive polymer blend which is suitable for processing by any method, including blow molding."[2]
- "...the conductive polymer blends have improved mechanical properties."[3]

[1] Page 3, lines 3 – 5 of the Office action mailed July 03, 2007.
[2] Column 3, lines 24 – 26 of US 6,331,586.
[3] Column 3, lines 34 – 35 of US 6,331,586.

- "A wide variety of articles may be produced from the polymer blend of the invention, [including] … components for electronic equipment."[4]

Since claim 1 has been amended to include the requirement that "the polymer blend includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers," as formerly claimed in claim 6, the Examiner's comments regarding claim 6 are particularly relevant. The Examiner commented that it would have been "obvious to use at least one polyamide and at least one polyether ketone or polyether sulfone as the blend polymers of Thielen et al."[5]

The *Saito et al.* (EP 1011164) also discloses a separator plate comprising a binder, which may be, for example, a thermosetting resin, a thermoplastic resin, or a rubber. The reference goes on to provide:

13 examples of thermosetting resins,

> **[0017]** As the thermosetting resin, there can be mentioned, for example, phenolic resin, polycarbodiimide resin, furfuryl alcohol resin, epoxy resin, cellulose, urea resin, melamine resin, unsaturated polyester resin, silicone resin, diallyl phthalate resin, bismaleimidetriazine resin, polyaminobismaleimide resin and aromatic polyimide resin. They can be used singly or in admixture of two or more kinds. [6]

30 examples of thermoplastic resins,

> **[0018]** As the thermoplastic resin, there can be mentioned, for example, polyethylene, polystyrene, polypropylene, polymethyl methacrylate, polyethylene terephthalate, polybutylene terephthalate, polyethersulfone, polycarbonate, polyoxamethylene, polyamide, polyimide, polyamideimide, polyvinyl alcohol, polyvinyl chloride, polyphenylsulfone, polyetherether ketone, polysulfone, polyether ketone, polyarylate, polyetherimide, polymethylpentene, fluororesin, polyoxybenzoyl ester resin, liquid crystal polyester resin, aromatic polyester, polyacetal, polyallylsulfone, polybenzimidazole, polyethernitrile, polythioethersulfone and polyphenylene ether. They can be used singly or in admixture of two or more kinds. [7]

16 examples of rubbers.

> **[0019]** As the rubber, there can be mentioned, for example, fluororubber, silicone rubber, butyl rubber, chloroprene rubber, nitrile rubber, nitrile-chloroprene rubber, chlorinated butyl rubber, epichlorohydrin rubber, epichlorohydrin-ethylene oxide rubber, epichlorohydrin-ethylene oxide-acrylic glycidyl ether terpolymer, urethane rubber, acrylic rubber, ethylene-propylene rubber, styrene rubber, butadiene rubber and natural rubber. They can be used singly or in admixture of two or more kinds. [8]

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[4] Column 11, lines 31 – 36 of US 6,331,586.
[5] Page 3, lines 20 – 22 of the Office action mailed July 03, 2007.
[6] Paragraph [0017] of *Saito et al.* (EP 1011164).
[7] Paragraph [0018] of *Saito et al.* (EP 1011164), (emphasis added).
[8] Paragraph [0019] of *Saito et al.* (EP 1011164).

The Examiner (on the basis of hindsight) notes that amongst at least 59 examples, *Saito et al.* mention polyethersulfone, polyamide and polyether ketone.

With regard to *Thielen et al.*, the Examiner acknowledges that "[t]he blend polymers may comprise a variety of polymers...."[9] Indeed, *Thielen et al.* disclose an infinite variety of polymers by stating that "[i]n general, any pair of polymers may be selected for a blend provided that the two polymers present at least some degree of immiscibility and preferably differ in their polarity."[10] *Thielen et al.* also make clear that an infinite variety of polymers can be used, stating:

> The polymers in the conductive blend of the invention can be homopolymers, copolymers, terpolymers, and/or polymers containing any number of different repeating units. Further, the polymer can be any type of polymer, such as a random polymer, alternating polymer, grafted polymer, block polymer, star-like polymer and/or comb-like polymer. The polymer can have the structure of an interpenetrating polymer network, simultaneous interpenetrating polymer network, or interpenetrating elastomeric network.[11]

The reference provides a list of specific examples of polymers:

> Specific examples of polymers include, but are not limited to, linear high molecular weight polymers such as polyethylene, poly(vinylchloride), polyisobutylene, polystyrene, polycaprolactam (nylon), polyisoprene, and the like.[12]

However, the Examiner (on the basis of hindsight) focuses on only two general classes of polymers within a listing of at least 30 general classes of polymers.

> Other general classes of polymers include polyamides, polycarbonates, polyelectrolytes, polyesters, polyethers, (polyhydroxy)benzenes, polyimides, polymers containing sulfur (such as polysulfides, (polyphenylene) sulfide, and polysulfones), polyolefins, polymethylbenzenes, polystyrene and styrene copolymers (ABS included), acetal polymers, acrylic polymers, acrylonitrile polymers and copolymers, polyolefins containing halogen (such as polyvinyl chloride and polyvinylidene chloride), fluoropolymers, ionomeric polymers, polymers containing ketone group(s), liquid crystal polymers, polyamide-imides, polymers containing olefinic double bond(s) (such as polybutadiene, polydicyclopentadiene), polyolefin copolymers, polyphenylene oxides, polyurethanes, thermoplastic elastomers and the like.[13]

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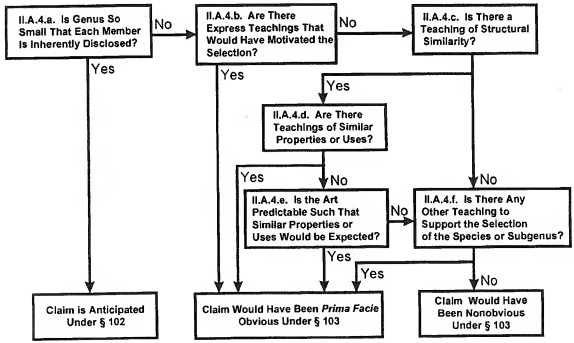
[9] Page 3, lines 8 – 9 of the Office action mailed July 03, 2007.
[10] Column 6, lines 45 – 48 of *Thielen et al.*, US 6,331,586.
[11] Column 6, lines 8 – 16 of *Thielen et al.*, US 6,331,586.
[12] Column 6, lines 17 – 21 of *Thielen et al.*, US 6,331,586.
[13] Column 6, lines 21 – 34 of *Thielen et al.*, US 6,331,586 (emphasis added).

"To establish a prima facie case of obviousness in a genus-species chemical composition situation … it is essential that Office personnel find some motivation or suggestion to make the claimed invention in light of the prior art teachings."[14] MPEP § 2144.08 provides a chart to assist an examiner's determination of whether a claimed species or subgenus would have been obvious to one of ordinary skill in the art at the time the invention was made. Although this chart is provided specifically with regard to the examination of claims directed to species of chemical compositions based upon a single prior art reference, Applicants respectfully assert that the chart is also useful in this case to determine whether it would have been obvious to arrive at a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers. If nothing else, the chart below provides an outline for the discussion that follows.

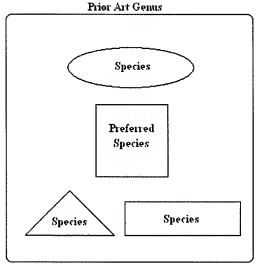


In light of the discussion above regarding the enormous variety of polymers discussed by both references, the Examiner will surely agree that the genus is not so small that each member is inherently disclosed. Thus, the next question is whether express teachings are

[14] MPEP § 2144.08.

provided that would have motivated the selection. Again, the Examiner has already acknowledged that neither of the cited references expressly teaches a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers.

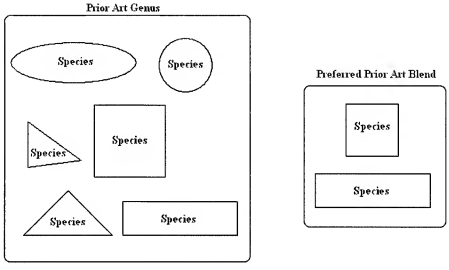
Next, MPEP § 2144.08 explains that "[i]f ... a [preferred] species or subgenus is structurally similar to that claimed, its disclosure may motivate one of ordinary skill in the art to choose the claimed species or subgenus from the genus, based on the reasonable expectation that structurally similar species usually have similar properties." The following (simplistic) illustration, may be helpful:



If the various geometric shapes within the prior art genus represent chemical structure, then according to MPEP § 2144.08 the preferred "square" species may motivate one of ordinary skill in the art to choose the "rectangular" species from the genus. However, the preferred "square" species could not be said to motivate one of ordinary skill in the art to select the "elliptical," or "triangular" species. In light of this rationale, MPEP § 2144.08 instructs examiners to consider whether the cited references provide "any teachings of a 'typical,' 'preferred,' or 'optimum' species or subgenus within the disclosed genus."[15]

[15] MPEP § 2144.08.

In the present case, a more complicated situation arises, because the claims are directed to a polymer blend. Thus, the illustration presented above would need to be altered as follows:



The preferred prior art blend, as illustrated above, could not be said to motivate one of ordinary skill in the art to select the "elliptical," or "triangular" species from the genus for incorporation into a blend with a species having a different shape/structure. At best, the preferred prior art blend might provide motivation for a skilled artisan to select a combination of structurally similar species to incorporate into a blend, for example two triangular species.

Indeed, the polymer blends which are disclosed in *Thielen et al.* as being very preferred are combinations comprising two polymers, which have very similar chemical structures, for example, a combination of high density polyethylene and ethylene propylene rubber. On the other hand, the amended claims require a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers. Thus, a skilled artisan would not learn from *Thielen et al.* that polyethersulfone or polyether ketone are suitable polymers in a polymer blend.

Finally, in an attempt to find any other teaching to support the proposed selection, the Examiner might be tempted to reemphasize that *Thielen et al.* disclose that "any pair of polymers may be selected for a blend provided that the two polymers present at least

some degree of immiscibility and preferably differ in their polarity."[16] However, this statement is far from an express disclosure of the claimed polymer blend, and amounts to little more than a statement that an infinite number of combinations could be attempted. Indeed, it was unobvious to arrive at a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers.

Moreover, the use of a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers, makes it possible for the bipolar plate for PEM fuel cells according to the present application to be used under higher temperatures than bipolar plates for PEM fuel cells, comprising, for example, a polymer blend of polyethylene and polystyrene. If a bipolar plate for PEM fuel cells comprises a polymer blend of polyethylene and polystyrene, the temperature of permanent use of this fuel cell is at about 90°C. If the bipolar plate for PEM fuel cells according to the present application is used, comprising a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers, this fuel cell can be operated under a higher permanent temperature than the one which has to be applied when a polymer blend comprising polyethylene and polystyrene is used. The higher operating temperature of the fuel cell comprising the bipolar plate according to presently amended claim 1 of the present application makes it possible to increase the reaction rate, which is in direct connection to strength of current, which can be obtained form the fuel cell. This is result is unexpected, and is, therefore, further evidence in support of the unobviousness of the present invention.

In addition, a bipolar plate comprising a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers has increased stability against peroxide-anions O_2^{2-}, which are present during the operating of a fuel cell. These very reactive anions unexpectedly cause less degradation to a bipolar plate according to the present invention. On the other hand, a polymer blend comprising polyethylene and polystyrene has a significantly lower stability against peroxide anions, causing a faster degradation of the bipolar plate.

Therefore, a bipolar plate comprising a polymer blend that includes at least one polyamide and at least one polyether ketone or polyether sulfone as blend polymers for

[16] Column 6, lines 45 – 48 of *Thielen et al.*, US 6,331,586.

PEM fuel cells according to amended claim 1, provides two unexpected results. First, the fuel cell can be operated under a higher permanent temperature. Second, a significantly improved stability against peroxide anions is present in the bipolar plate during operation.

For at least these reasons, the claimed invention is unobvious over *Saito et al.* (EP 1011164) in view of *Thielen et al.* (US 6,331,586), and the present rejection should be withdrawn.

In Conclusion:

The present application is in condition for allowance. Again, applicants are thankful for the Examiner's diligent efforts to advance this application to allowance, and request favorable action in this matter. In order to facilitate the resolution of any issues or questions presented by this paper, the Examiner is welcome to contact the undersigned by phone to further the discussion.

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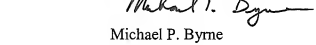

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